

# Endoscopic radical hypophysectomy: how I do it

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## Abstract

**Background** Total hypophysectomy it is a classical procedure that currently has many indications especially in patients with Cushing syndrome without good endocrine control. Expanded endonasal endoscopic techniques grant us an alternative standpoint to the classic trans-sphenoidal microscopic approach and a comprehensive assessment of the process

**Method** The author provides technical nuances and describe step by step the radical endoscopic hypophysectomy. The study of cadaveric specimens adds clarifying dissections.

**Conclusions** Radical hypophysectomy is an easily replicable and safe procedure. The most important morbidity is the intraoperative cerebrospinal fluid (CSF) leakage, which is

inherent to this technique and can be successfully prevented with a pedicled nasoseptal flap reconstruction.

**Keywords** Extended endonasal endoscopic · Radical hypophysectomy · Cushing's disease · Pituitary tumour

## Relevant surgical anatomy

The hypophyseal capsule is a thin layer that covers and protects all the pituitary gland. In addition, both meningeal and periosteal layers enclose the sellar region. The periosteal layer strong attach to the sphenoid bone extend toward the anterior, posterior and inferior limits of the pituitary region [1]. The meningeal layer located around pituitary gland form the internal wall of the cavernous sinus in the lateral side; this layer is perforated by the inferior hypophyseal arteries that arise from the meningohypophyseal trunk, a stemming branch on the intracavernous carotid artery posterior loop. Tiny ligaments, named pituitary ligaments [5], hold the pituitary capsule to the meningeal layer. Besides, the meningeal layer is anchored to the medial side of the intracavernous carotid artery by intracavernous slim fibrous strips (Fig. 1).

## Key Points

1. Thorough reconstruction planning.
2. Nasoseptal flap tailoring is usually possible. It is the best fit in most cases.
3. Wide bilateral sphenoidotomy and four-hand technique allow a better microsurgery.
4. Wide sellar prominence's anterior wall resection.
5. Open up both two dural layers on the anterior wall of the sella turcica.
6. Inferior hypophyseal capsule dissection first, followed by lateral side dissection.
7. Bleeding halting with injectable hemostatics on the CS medial wall.
8. Identification and coagulation of inferior hypophyseal arteries.
9. Arachnoid dissection and coagulation / cutting of the hypophyseal stalk.
10. Pituitary ligament remnants sectioning and neurohypophysis releasing from the dorsum sellae.

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## Description of the technique

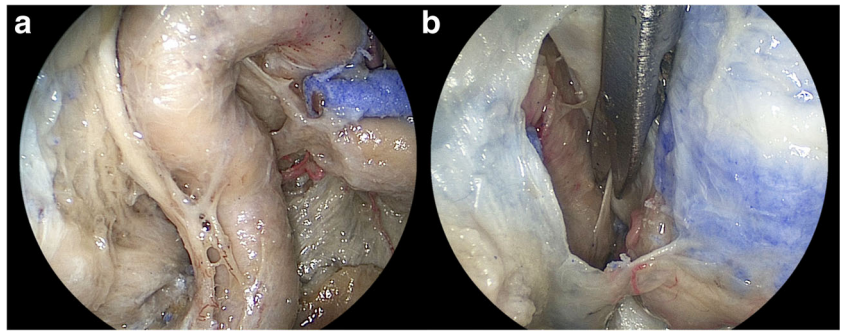
### Trans-sphenoidal approach

The surgeon team is located on the right side of the patient to allow a comfortable “four hands” technique [6]. Middle turbinectomy is not mandatory routinely. A nasoseptal flap [3] is tailored and stored in the rhinopharynx. The nasal septum's back quarter is resected. Once a wide sphenoidotomy is

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**Fig. 1** Corpse dissection. **a** Meningeal layer and hypophyseal capsule. **b** Intracavernous fibrous strips



made, a bilateral posterior ethmoidectomy may be helpful towards granting a better view of the tuberculum sellae.

### Pituitary prominence exposure

Intrasphenoidal septa are drilled out until pituitary prominence is clearly identified. We usually look for many anatomical landmarks during the approach (medial optico-carotid recess, tuberculum, etc.) [7, 9]. Next, the sellar prominence is drilled, preserving a bone piece for its later restoration. A large dural exposure is mandatory.

### Dural opening

We perform a U-shaped dural incision with a no. 11 scalpel blade (Fig. 2a). The dural flap remains attached to the tuberculum sellae. It must be wide on its lower side and as near as possible to the parasellar carotid portion on the lateral side. If necessary, lateral discharge cuts can be made.

### Pituitary gland dissection

Once the anterior wall of the gland is exposed, we start separating the gland from the inferior meningeal layer, trying to avoid damaging the pituitary capsule. It is important to remember that the inferior dissection is safe without any major neurovascular structures nearby. If cavernous sinus (CS)

bleeding occurs, it can be easily stopped with injectable haemostatics (Fig. 2b).

Up next, lateral walls are dissected, following an inferior superior axis (Fig. 3a). Tears on the meningeal layer, CS medial wall, may produce bleedings which are managed with the formerly mentioned haemostatics. Before we go forward, the gland dissection has to be completed on the sagittal plane so the dorsum sellae can be seen. Perception that the hypophyseal gland is bigger than anticipated is usual. Bear in mind the presence of the inferior hypophyseal artery on the posterolateral borders, which should be cauterised in order to prevent any bleedings.

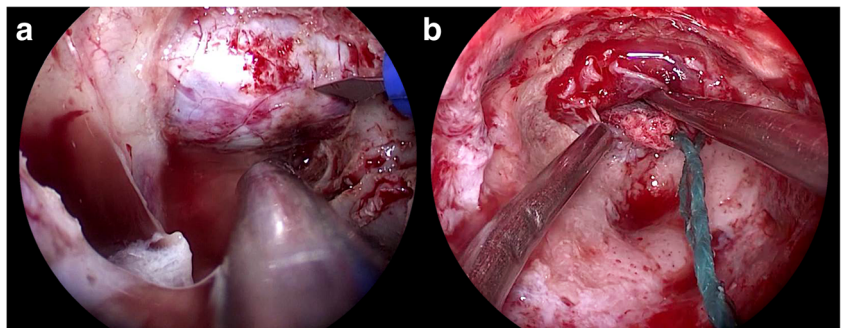
In case the CS medial wall is widely transected, some intracavernous fibrous strips may be seen; we usually dissect them to unattach the CS medial wall and be able to continue the dissection safely.

The superior gland dissection, usually the last step, needs perfect haemostasis and has to be the gentlest one. The gland is carefully depressed down with microdissectors, the arachnoid membrane shows up through diaphragm sellae; it is adhered to its upper side (Fig. 3b). Release it cautiously until the hypophyseal stalk is at sight.

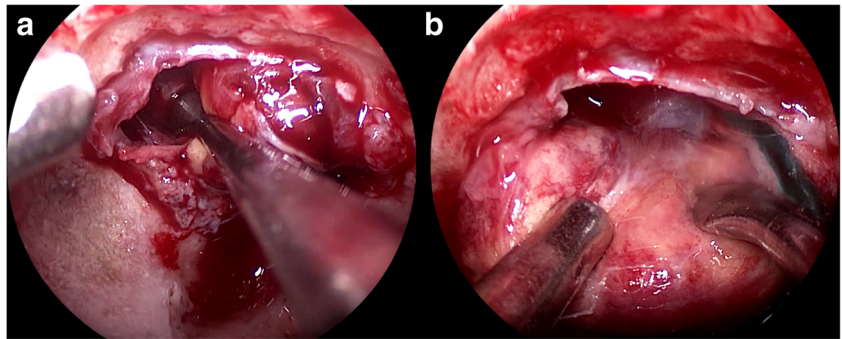
### Pituitary gland resection

The pituitary stalk is coagulated as near to the gland as possible in order to prevent any damage to the chiasmatic supply

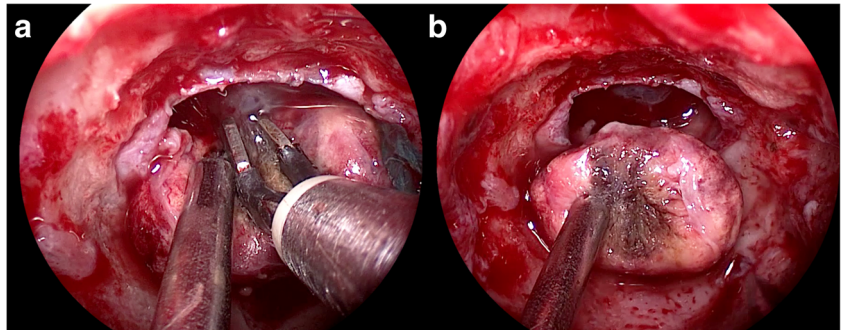
**Fig. 2** **a** Wide dural exposure. **b** Hypophyseal capsule's inferior wall dissection



**Fig. 3** **a** Right lateral wall of the hypophyseal capsule dissection. **b** Arachnoid plane dissection and recognition of the pituitary stalk



**Fig. 4** **a** Stalk's root cauterisation. **b** Hypophysis en bloc resection



(Fig. 4a). Then, it is cut using microscissors (Fig. 4b). If the gland remains fixed, recall the tiny “pituitary ligaments” that may have not been torn already and they should be cut them. On the other hand, the neurohypophysis, dug inside the dorsum sellae, impedes the extraction. It is necessary to pull smoothly and suck the portion resting on the dorsum sellae.

### Reconstruction

The sella turcica is now totally empty. The diaphragma sellae and the herniated arachnoid membrane are visible. A low flow cerebrospinal fluid (CSF) leak may appear after a proper dissection (Fig. 5a). A Duragen (Integra, Plainsboro, NJ, USA) layer is encased in the sellar prominence as the first reconstruction element. Then, the nasoseptal flap is placed on the

defect (Fig. 5b). A Surgicel (Ethicon, Somerville, NJ, USA) cover is allocated on the flap borders to prevent small bleedings from separating it. Finally, nasal plugs are put in place.

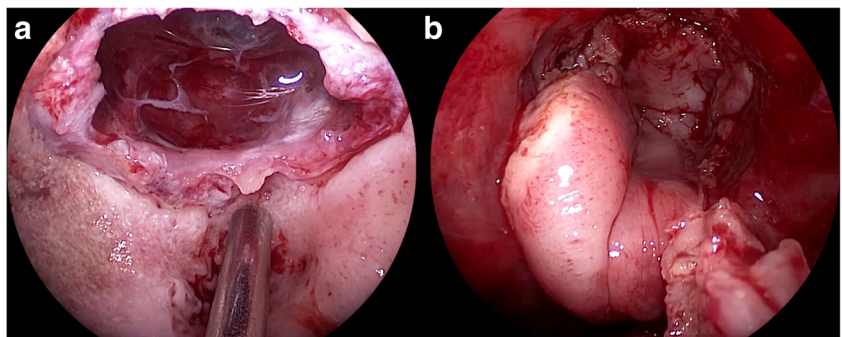
### Indications

Multiple hormone secreting microadenomas: those which involve the whole gland and those refractory to pharmacological measures.

Particularly indicated in refractory or recurrent Cushing's syndrome with several pathological areas inside the gland.

Central Cushing's syndrome without clear radiological evidence of hypophyseal disease [4].

**Fig. 5** **a** Empty sella turcica **b** Nasoseptal flap place on the sphenoid sinus



## Limitations

1. This technique is restricted to intrasellar adenomas. Suprasellar or CS-invading macroadenomas require alternative approaches.
2. Other non-adenomatous hypophyseal diseases, such as craniopharyngiomas, hypophysitis and Rathke's pouch cysts, can modify the gland's normal anatomy.

## How to avoid complications

**Last things first** Think of closing before even start planning the approach. A proper nasoseptal flap is imperative. Extra options must be considered on the assumption the flap's making is unavailable [8].

**Go big or go home** A wide sphenoidotomy eases the dissection. Being unable to perform delicate movements because of space limitations is a frequent setback. Do not start dissecting until we get as comfortable as it gets

**Lids out** An ample resection of the anterior side of the sellar prominence is the key to grant en bloc mobilisation of the gland.

**Know your enemy** Appropriate anatomical knowledge of the dural layers surrounding the hypophysis lets us understand how to disengage the gland from its adherences.

**There will be blood** CS bleeding is a sure thing due to tiny tears on its medial wall. We must be used to injectable hemostatics and be ready to employ them during the hypophyseal capsule dissection.

**Be cool, stay dry** Two hand microsurgical dissection helps us keep the arachnoid integrity and avoid large CSF losses.

## Specific perioperative considerations

- Collaborative work with the Endocrinology Department is strongly suggested. Complete substitutive hormone therapy has to be taken in consideration from the beginning. Expect triple-phase response from surgical trauma to the stalk.
- Silastic nasoseptal button usage during closure might help prevent septal necrosis. We recommend its intraoperative application and withdrawal 2 weeks later. Nasal plugs can be withdrawn 4-5 days after surgery.

## Specific information must be given to the patient about surgery and potential risks

Right information about other treatment options such as radiosurgery (and its pitfalls) should be transmitted to the patient [2]. Life-long substitutive hormonal therapy has to be mentioned as well.

**Compliance with ethical standards** The study with cadaveric specimens was approved by the Research Ethics board in our hospital.

**Conflicts of interest** None.

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